PATENT ABSTRACTS OF JAPAN

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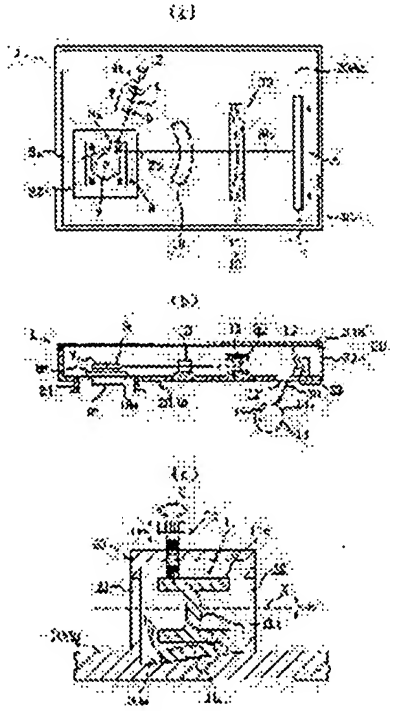
(54) OPTICAL SCANNER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an optical scanner equipped with the mechanism which can correct the scanning line bend and plane tilt due to the distortion generated when molding optical elements, such as a lens and a mirror easily, without deforming the portion which functions as the lens or the mirror.

SOLUTION: A scanning lens 11 is molded from the plastic material integrally with a lens part (function part) 11a, a rib 11b which reinforces the lens part 11a and a supporting part 11c which support flexibly the portion which consists of the lens part 11a and the rib 11b gradient-adjustably in the subscanning direction. A lens angle adjusting screw 33 is formed in the center of the top plate part of a holding part 30, by moving the screw 3 to the vertical direction (the direction of arrow D) while turning the screw 33 to the forward and backward direction (the direction of arrow C), the portion which consists of the lens part 11a of the scanning lens 11 and the rib 11b can be turned to the subscanning direction (the direction of arrow B), and the inclination of the subscanning direction of the lens part 11a can be adjusted easily.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] In light-scanning equipment equipped with the scan optical system which makes the light beam injected from the laser light source shake at a main scanning direction, and the optical element group which carries out image formation of the light beam from the scan optical system concerned to the irradiated plane which moves in the direction of vertical scanning At least one of the optical elements which constitute said optical element group is light-scanning equipment characterized by really fabricating the function part which functions as a lens or a mirror, and the supporter which supports the function part concerned flexibly possible [gradient adjustment] in the direction of vertical scanning.
[Claim 2] In light-scanning equipment equipped with the scan optical system which makes the light beam injected from two or more laser light sources shake at a main scanning direction, and the optical element group which carries out image formation of two or more light beams from the scan optical system concerned to the irradiated plane which moves in the direction of vertical scanning respectively At least one of the optical elements which constitute said optical element group is light-scanning equipment characterized by really fabricating the function part which functions as a lens or a mirror, and the supporter which supports the function part concerned flexibly possible [gradient adjustment] in the direction of vertical scanning.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is concerned with the light-scanning equipment carried in a digital copier, laser facsimile, a laser printing machine, a laser plotter, etc., and relates to light-scanning equipment equipped with the device which amends scanning-line deflection etc. by inclining and adjusting the optical element which carries out image formation especially of the light beam to scan layers-ed, such as a photo conductor, in the direction of vertical scanning.
[0002]
[Description of the Prior Art] Deflecting the light beam injected from the laser light source to a main scanning direction by irradiating a polygon mirror In image formation equipment equipped with the light-scanning equipment which irradiates scanned body surfaces, such as a photo conductor which moves in the direction of vertical scanning, through Ftheta lens, a scan lens, a scan mirror, etc. Slight deformation of optical elements, such as Ftheta lens, a scan lens, and a scan mirror, produces an optical-path error, and the error becomes the magnitude which cannot be disregarded on a scan layer-ed. When especially deformation of an optical element has occurred in the direction of vertical scanning, it becomes the cause of becoming easy to produce scanning-line deflection and reducing the quality of an output image. The problem of the debasement of the output image by deformation of such an optical element becomes still more remarkable in multi-colored picture image formation equipment. For example, it sets to the multi-colored picture image formation equipment of a tandem system. As shown in drawing 5 , the light beams Lc, Lm, Ly, and Lk injected from four laser light sources by irradiating the polygon mirror 51 from the direction which differ at a time two beams By reflecting two beams at a time in hard flow, deviating in the direction of vertical scanning, leading to the scan mirrors (clinch mirror) 53c, 53m, 53y, and 53k through the Ftheta lenses 52c, 52m, 52y, and 52k, respectively, and making it reflect caudad It is made to carry out the exposure scan of the photo conductor drums 54c, 54m, 54y, and 54k prepared for every color of CMYK (cyanogen, a Magenta, yellow, black) with a separate beam respectively. Four photo conductor drums 54c, 54m, 54y, and 54k are installed in the conveyance direction of output paper, the exposure scan of the separate light beam is carried out respectively at coincidence, an electrostatic latent image is written in each photo conductor drums 54c, 54m, 54y, and 54k, and after developing negatives with the development counter of a respectively different color, a full color image is outputted by carrying out a sequential imprint and laying the image of each color on top of output paper. Although the latent image of two or more classification by color is written in, they are piled up after development and a multi-colored picture image is formed on a photo conductor with such multi-colored picture image formation equipment by drawing and scanning respectively the light beam injected from two or more laser light sources to the optical path according to individual, how the scanning line of each light beam is correctly piled up in this case becomes the point which raises image quality.
[0003] As a gestalt of the heavy error of each scanning line, there are gap of a vertical-scanning location, gap of an inclination, and deflection. Generally, about gap of an inclination, the amendment for raising

its its image quality by include-angle accommodation of the clinch mirror in an optical path etc. is made by control of the timing of the write-in initiation about gap of a vertical-scanning location. About the bend, the relative-position precision of optical elements, such as a lens and a mirror, which is the generating factor of deflection was raised, and deterioration of image quality is avoided by bringing the absolute magnitude of scanning-line deflection close to zero as much as possible. By the way, the optical element which used plastic material from viewpoints, such as the ease of low cost and handling, came to be used in recent years. However, while the optical element which used plastic material is excellent in mass-production nature, the reasons of cooling after taking out from the distribution metallurgy mold of whenever [metal mold internal temperature / at the time of shaping] not being performed uniformly to a product configuration separates from it from the thing of an ideal in many cases. Moreover, since the coefficient of thermal expansion is high compared with optical housing which supports this, if the optical element which used plastic material has the large restraint of optical housing to an optical element, it will tend to deform the optical element itself by the environmental variation, i.e., temperature fluctuation. If the optical element which constitutes the optical element group which carries out image formation of the light beam to a photo conductor is deforming, the slight deformation will produce the error of an optical path, and will become the magnitude which cannot be disregarded on a scan layer. When especially deformation has occurred in the direction of vertical scanning, it becomes easy to generate scanning-line deflection. He has the curve adjustment means made to transform a plastic lens compulsorily, and is trying for curve adjustment of the plastic lens by the curve adjustment means to amend the scanning-line deflection by the distortion at the time of molding with the technique indicated by JP,10-268217,A that such a problem should be coped with. This technique controls deformation intentionally, using conversely the property which is a plastic lens of being easy to deform.

[0004]

[Problem(s) to be Solved by the Invention] However, with the technique indicated by JP,10-268217,A, since the scanning-line deflection by the distortion at the time of lens molding is amended by making the plastic lens itself transform compulsorily and making a lens side transform, a device is not only complicated, but an original lens function may be spoiled by deformation of a lens side. Then, the technical problem which this invention tends to solve is to offer light-scanning equipment equipped with the device which can be amended more simply than before, without making the part which functions considering the scanning-line deflection by the distortion at the time of molding of optical elements, such as a lens and a mirror, or the failure by the field as a lens or a mirror deform.

[0005]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, invention according to claim 1 In light-scanning equipment equipped with the scan optical system which makes the light beam injected from the laser light source shake at a main scanning direction, and the optical element group which carries out image formation of the light beam from the scan optical system concerned to the irradiated plane which moves in the direction of vertical scanning At least one of the optical elements which constitute said optical element group is characterized by really fabricating the function part which functions as a lens or a mirror, and the supporter which supports the function part concerned flexibly possible [gradient adjustment] in the direction of vertical scanning. Moreover, the scan optical system which makes the light beam by which invention according to claim 2 was injected from two or more laser light sources shake at a main scanning direction, In light-scanning equipment equipped with the optical element group which carries out image formation of two or more light beams from the scan optical system concerned to the irradiated plane which moves in the direction of vertical scanning respectively At least one of the optical elements which constitute said optical element group is characterized by really fabricating the function part which functions as a lens or a mirror, and the supporter which supports the function part concerned flexibly possible [gradient adjustment] in the direction of vertical scanning. In addition, in invention according to claim 1 or 2, said optical element may be a lens for a scan, or a field failure correcting lens. Moreover, in invention according to claim 1 or 2, said optical element may be a mirror for a scan, or a field failure amendment mirror.

[0006]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained. The top view (condition which removed covering of a case) and drawing 1 (b) which show an example of the gestalt of operation of the light-scanning equipment which drawing 1 (a) requires for this invention are drawing of longitudinal section. This light-scanning equipment 1 carries out the light guide of the light beam 3a by which outgoing radiation was carried out to the polygon mirror 9 of the polygon scanner 8 through the 1st optical element group 7 from a laser light source 2. Deflecting a main scanning direction (the direction of arrow-head A in drawing 1 (a)) by making it reflect by mirror side 9a from which an include angle changes with rotation Light scanning is performed by carrying out the light guide of the deviation light 3b to surface (scan layer-ed) 14a of the photo conductor drum 14 which rotates through the 2nd optical element group 13 in the direction of vertical scanning (the direction of arrow-head B in drawing 1 (b)). The above-mentioned laser light source 2, the 1st optical element group 7, the polygon scanner 8, and the 2nd optical group 13 are stored in one case 20. What combined two or more sources of luminescence as a laser light source 2, a semiconductor laser array, etc. have been used with improvement in the speed or colorization of an image output in recent years. The 1st optical element group 7 consists of the coupling lens 4, diaphragm 5, and line image image formation optical system 6. The 2nd optical element group 13 consists of the ftheta lens 10, a scan lens 11, and a scan mirror (clinch mirror) 12. A case 20 consists of body of case 20A in which a laser light source 2, the 1st optical element group 7, the polygon scanner 8, and the 2nd optical element group 13 were installed, and covering 20B which blockades up opening of body of case 20A. The light beam outgoing radiation aperture 21 is formed in pars-basilaris-ossis-occipitalis 20Aa of body of case 20A. The light beam outgoing radiation aperture 21 is blockaded with the transparent glass plate 22, in order that dust, a toner, etc. may prevent entering in a case 20 from there. A laser light source 2 emits divergence light beam 3a. After light beam 3a from a laser light source 2 is changed into the abbreviation parallel flux of light and extracted to the predetermined diameter of the flux of light according to diaphragm 5 by penetrating the coupling lens 4, image formation of it is carried out to the line prolonged in mirror side 9a of the polygon scanner 8 in a main scanning direction according to the line image image formation optical system 6 which has refractive power in the direction of vertical scanning. The polygon scanner 8 is equipped with the polygon mirror 9 and the motor 16 made to rotate this at uniform velocity, and deflects incoming beams in constant angular velocity by include-angle change of mirror side 9a accompanying rotation of the polygon mirror 9. As by return, after it carries out incidence to the scan mirror 12 through the ftheta lens 10 and the scan lens 11, and being reflected caudad in this mirror side, outgoing radiation of the light beam (deviation light) 3b reflected by the polygon mirror 9 is carried out out of a case 20 through the light beam outgoing radiation aperture 21, and it is irradiated by surface 14a of the photo conductor drum 14. By carrying out intensity modulation of the laser light source 2 according to the image which should be outputted at this time, the electrostatic latent image of an output image is written in surface 14a of the photo conductor drum 14 in the form of a dot pattern by blinking light beam 3b.
[0007] Since it said that it could manufacture cheaply in recent years, and handling was easy, what used plastic material for various optical elements, such as a lens and a mirror, came to be used. However, in this kind of light-scanning equipment, since many optical elements of the structure prolonged for a long time in the main scanning direction like the ftheta lens 10 or scan lens 11 grade are used, when plastic material is used, it is not only easy to deform in process of component shaping in the direction of vertical scanning, but it may deform in the direction of vertical scanning by the method of maintenance. It is thought effective by making it hold and deform into the condition of having applied the force in the direction which loses deflection for the optical element itself like [since the deflection to the direction of vertical scanning of an optical element causes scanning-line deflection on a photo conductor] the technique indicated by JP,10-268217,A to decrease the amount of deflection. However, since the rib is prepared in many cases in order to give reinforcement to this kind of optical element, it is difficult to decrease the amount of deflection of the optical element itself in many cases. Then, the configuration of a function part where this invention functions as the lens or mirror of the optical element which

constitutes an optical element group tends to offer the light-scanning equipment which can amend easily the deflection of an optical element (function part), and the scanning-line deflection by the failure by the field, without making it change.

[0008] The gestalt of this operation explains to the scan lens 11 and its attaching part 30 taking the case of the case where the invention in this application is applied. The sectional view where drawing 1 (c) looked at the part from the main scanning direction, and drawing 2 are the sectional views seen from vertical scanning. Drawing 3 is a whole perspective view which illustrates the gestalt of operation of the scan lens 11. The scan lens 11 really comes to fabricate supporter 11c which supports flexibly the part which consists of lens section (function part) 11a, rib 11b which reinforces lens section 11a, and lens section 11a and rib 11b possible [gradient adjustment] in the direction of vertical scanning with plastic material so that it may illustrate. As rib 11b encloses the perimeter of lens section 11a, it is formed in the shape of a rectangle frame. Supporter 11c consists of a part of the shape of flat spring prepared in the lower part of rib 11b. The attaching part 30 was formed in the structure of the cube type prolonged in the main scanning direction really formed in pars-basilaris-ossis-occipitalis 20Aa of body of case 20A, and has held the scan lens 11 in the interior. Before and after the attaching part 30, window parts 31 and 32 are formed in order to expose lens section 11a of the scan lens 11. Base 30a of an attaching part 30 inclines aslant in the direction of vertical scanning in consideration of the inclination of supporter 11c to the lower part of rib 11b. The lens include-angle adjusting screw 33 is formed in the longitudinal direction center section of the head-lining section of an attaching part 30. The lens include-angle adjusting screw 33 is made to screw in the **** hole which was made to penetrate the head-lining section of an attaching part 30, and was formed from the upper part, and is prepared, and the lower tip is in contact with the top face of rib 11b of the scan lens 11. According to the gestalt of this operation, as shown in drawing 1 (c), by making forward hard flow (the direction of arrow-head C) rotate the lens include-angle adjusting screw 33, and making it move in the vertical direction (the direction of arrow-head D), the part which consists of lens section 11a of the scan lens 11 and rib 11b can be rotated in the direction of vertical scanning (the direction of arrow-head B), and the inclination of the direction of vertical scanning of lens section 11a can be adjusted easily. Since lens section 11a is reinforced by rib 11b, it inclines by the elastic deformation of only supporter 11c in that case and adjustment is made, lens section 11a does not deform. Therefore, the scanning-line deflection by the distortion at the time of molding of lens section 11a and the failure by the field can be amended more simply than before, without making lens section 11a transform. Although the above-mentioned example is related with a plastic lens and its attaching part, the invention in this application is applicable also to the optical element which has reflectors, such as a scan mirror and a field failure amendment mirror, and its attaching part.

[0009] The whole perspective view as which drawing 4 (a) illustrates the gestalt of operation of a scan mirror, and drawing 4 (b) are sectional views which illustrate the structure of a scan mirror and its attaching part. The scan mirror 40 really comes to fabricate supporter 40c which supports flexibly the part which consists of mirror section (function part) 40a, rib 40b which reinforces mirror section 40a, and mirror section 40a and rib 40b possible [gradient adjustment] in the direction of vertical scanning with plastic material so that it may illustrate. As rib 40b encloses the perimeter of mirror section 40a, it is formed in the shape of a rectangle frame. Supporter 40c consists of a part of the shape of flat spring prepared in the lower part of rib 40b. The attaching part 41 was formed in the structure of the cube type prolonged in the main scanning direction really formed in the pars basilaris ossis occipitalis of the body 20 of a case etc., and has held the scan mirror 40 in the interior. The window part 42 is formed in one side of an attaching part 41 in order to expose mirror section 40a of the scan mirror 40. Base 41a of an attaching part 41 inclines aslant in the direction of vertical scanning in consideration of the inclination of supporter 42c to the lower part of rib 40b. The mirror include-angle adjusting screw 43 is formed in the longitudinal direction center section of the head-lining section of an attaching part 41. The mirror include-angle adjusting screw 43 is made to screw in the **** hole which was made to penetrate the head-lining section of an attaching part 41, and was formed from the upper part, and is prepared, and the lower tip is in contact with the top face of rib 40b of the scan mirror 40. According to the gestalt of this

operation, as shown in drawing 1 (c), by making forward hard flow (the direction of arrow-head C) rotate the mirror include-angle adjusting screw 43, and making it move in the vertical direction (the direction of arrow-head D), the part which consists of mirror section 40a of the scan mirror 40 and rib 40b can be rotated in the direction of vertical scanning (the direction of arrow-head B), and the inclination of the direction of vertical scanning of mirror section 40a can be adjusted easily. Since mirror section 40a is reinforced by rib 40b, it inclines by the elastic deformation of only supporter 40c in that case and adjustment is made, mirror section 40a does not deform. Therefore, the scanning-line deflection by the distortion at the time of molding of mirror section 40a and the failure by the field can be amended more simply than before, without making mirror section 40a transform.

[0010] In addition, although the gestalt of the above-mentioned operation explained taking the case of the light-scanning equipment of the type which scans the light beam injected from the laser light source, and writes in the one scanned body As for the invention in this application, it is undoubted that the light beam injected from two or more laser light sources is scanned to coincidence, and it can apply effective also in the light-scanning equipment of the type which writes in two or more places of the one scanned body at coincidence, and the type which writes in two or more scanned bodies at coincidence. For example, it sets to the light-scanning equipment of the multi-colored picture image formation equipment of a tandem system as shown in drawing 5 . The optical element 52c and 52m which constitutes an optical element group, for example, Ftheta lenses, By applying the structure (for example, structure as shown in drawing 1 and drawing 4) of the invention in this application of 52y, 52k, the scan mirrors 53c, 53m, 53y, and 53k, and those attaching parts Since the scanning-line deflection by the distortion at the time of molding of those lens sections and mirror sections and the failure by the field can be amended simply, without making the lens section and the mirror section transform, the scanning line of each light beam can be piled up correctly, and image quality can be raised. If the direction and amount of all the scanning lines of CMYK are comparable even if scanning-line deflection has arisen, color gap is not conspicuous and can be performed.

[0011]

[Effect of the Invention] Since it can store in a desired value, without making the part which functions considering the scanning-line deflection by the distortion at the time of molding of optical elements, such as a lens and a mirror, or the failure by the field as a lens or a mirror deform as explained above according to the light-scanning equipment of the invention in this application, the tolerance over the form tolerance of an optical element item and the attachment tolerance to light-scanning equipment can be made to ease effectively. Since scanning-line deflection and the failure by the field can be easily stored in a desired value so that two or more scanning lines may lap if the invention in this application is applied to the light-scanning equipment of multi-colored picture image formation equipment, a good image with little color gap comes to be obtained easily.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] (a) is the sectional view where the top view showing an example of the gestalt of operation of the light-scanning equipment concerning this invention and (b) looked at drawing of longitudinal section of this light-scanning equipment, and (c) looked at the scan lens and the part of an attaching part of this light-scanning equipment from the main scanning direction.
[Drawing 2] It is the sectional view which looked at the scan lens and the part of an attaching part of the light-scanning equipment shown in drawing 1 from vertical scanning.
[Drawing 3] It is the perspective view of the scan lens shown in drawing 1 and drawing 2 .
[Drawing 4] The perspective view of a scan mirror in which (a) shows an example of the gestalt of operation of the invention in this application, and (b) are the sectional views which looked at this scan mirror and the part of the attaching part from the main scanning direction.
[Drawing 5] It is the important section schematic diagram of the multi-colored picture image formation equipment of a tandem system.
[Description of Notations]
1: Light-scanning equipment
2: Laser light source
3a: Light beam
3b: Deviation light
4: Coupling lens
5: Drawing
6: Line image image formation optical system
7: The 1st optical element group
9: Polygon mirror
10: ftheta lens
11: Scan lens
11a: Lens section (function part)
11b: Rib
11c: Supporter
12: Scan mirror
13: The 2nd optical element group
14: Photo conductor drum
14a: A scan layer-ed
31 32: Window part
33: Lens include-angle adjusting screw
40: Scan mirror
40a: Mirror section (function part)
40b: Rib
40c: Supporter

41: Attaching part
42: Window part
43: Mirror include-angle adjusting screw

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[Drawing 2] It is the sectional view which looked at the scan lens and the part of an attaching part of the light-scanning equipment shown in drawing 1 from vertical scanning.
[Drawing 3] It is the perspective view of the scan lens shown in drawing 1 and drawing 2 .
[Drawing 4] The perspective view of a scan mirror in which (a) shows an example of the gestalt of operation of the invention in this application, and (b) are the sectional views which looked at this scan mirror and the part of the attaching part from the main scanning direction.
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33: Lens include-angle adjusting screw
40: Scan mirror
40a: Mirror section (function part)
40b: Rib
40c: Supporter

41: Attaching part
42: Window part
43: Mirror include-angle adjusting screw

[Translation done.]

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審査請求　未請求　請求項の数２　ＯＬ　（全６頁）

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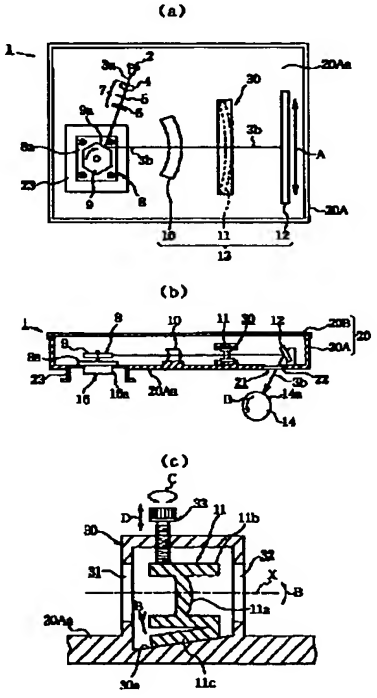
Ｆターム(参考)　2H045 CA02 CA33 CA53 CA93 DA02 DA04

(54)【発明の名称】　光走査装置

(57)【要約】
【課題】　レンズやミラーなどの光学素子の成型時の歪みによる走査線曲がりや面倒れを、レンズまたはミラーとして機能する部分を変形させることなく、簡易に補正できる機構を備えた光走査装置を提供する。
【解決手段】　走査レンズ１１は、レンズ部（機能部）１１ａと、レンズ部１１ａを補強するリブ１１ｂと、レンズ部１１ａおよびリブ１１ｂからなる部分を副走査方向に傾度調整可能に弾力的に支持する支持部１１ｃとをプラスチック材料により一体成形してなる。保持部３０の天井部中央にはレンズ角度調節ねじ３３が設けられており、ねじ３３を正逆方向（矢印Ｃ方向）に回動させて上下方向（矢印Ｄ方向）に移動させることにより、走査レンズ１１のレンズ部１１ａおよびリブ１１ｂからなる部分を副走査方向（矢印Ｂ方向）に回動させて、レンズ部１１ａの副走査方向の傾きを容易に調整することができる。



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【特許請求の範囲】

【請求項1】　レーザ光源から射出された光ビームを主走査方向に振らせる走査光学系と、当該走査光学系からの光ビームを副走査方向に移動する被照射面に結像させる光学素子群とを備えた光走査装置において、

前記光学素子群を構成する光学素子のうちの少なくとも1つは、レンズまたはミラーとして機能する機能部と当該機能部を副走査方向に傾度調整可能に弾力的に支持する支持部とを一体成形したものであることを特徴とする光走査装置。

【請求項2】　複数のレーザ光源から射出された光ビームを主走査方向に振らせる走査光学系と、当該走査光学系からの複数の光ビームを、副走査方向に移動する被照射面に各々結像させる光学素子群とを備えた光走査装置において、

前記光学素子群を構成する光学素子のうちの少なくとも1つは、レンズまたはミラーとして機能する機能部と当該機能部を副走査方向に傾度調整可能に弾力的に支持する支持部とを一体成形したものであることを特徴とする光走査装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、デジタル複写機、レーザファクシミリ、レーザ印刷機、レーザプロッタなどに搭載される光走査装置にかかわり、特に光ビームを感光体などの被走査面に結像させる光学素子を副走査方向に傾き調整することにより走査線曲がりなどを補正する機構を備えた光走査装置に関する。

【0002】

【従来の技術】レーザ光源から射出された光ビームを、ポリゴンミラーに照射することにより主走査方向に偏向しつつ、Fθレンズ、走査レンズ、走査ミラーなどを介して、副走査方向に移動する感光体などの被走査体表面に照射する光走査装置を備えた画像形成装置においては、Fθレンズ、走査レンズ、走査ミラーなどの光学素子のわずかな変形が光路誤差を生じさせ、その誤差が被走査面上では無視できない大きさになる。とくに光学素子の変形が副走査方向に発生している場合、走査線曲がりが生じやすくなり、出力画像の品質を低下させる原因となる。このような光学素子の変形による出力画像の品質低下の問題は、多色画像形成装置において更に顕著となる。たとえば、タンデム方式の多色画像形成装置においては、図5に示すように、4個のレーザ光源から射出された光ビームLc、Lm、Ly、Lkを、2ビームづつ異なる方向からポリゴンミラー51に照射することにより、2ビームづつ逆方向に反射させて副走査方向に偏向し、それぞれFθレンズ52c、52m、52y、52kを通して走査ミラー（折り返しミラー）53c、53m、53y、53kに導き、下方に反射させることにより、CMYK（シアン、マゼンタ、イエロー、ブラック）の各色毎に設けられた感光体ドラム54c、54m、54y、54kを各々別々のビームで露光走査するようにしている。4つの感光体ドラム54c、54m、54y、54kは出力紙の搬送方向に並設されており、各感光体ドラム54c、54m、54y、54kに各々別々の光ビームを同時に露光走査して静電潜像を書き込み、各々異なる色の現像器で現像した後、各色の画像を出力紙に順次転写して重ね合わせることによりフルカラー画像が出力される。このような多色画像形成装置では、複数のレーザ光源から射出された光ビームを各々個別の光路に導いて走査することにより感光体上に複数色分の潜像を書き込み、現像後それらを重ね合わせて多色画像を形成するのであるが、この場合、各光ビームの走査線をいかに正確に重ね合わせるかが画像品質を向上させるポイントとなる。

【0003】各走査線の重ね誤差の形態としては、副走査位置のズレ、傾きのズレ、曲がりがある。一般的に、副走査位置のズレについては書込開始のタイミングの制御によって、傾きのズレについては光路中の折り返しミラー等の角度調節によってそれぞれ画像品質を向上させるための補正がなされている。曲がりについては、曲がりの発生要因であるレンズやミラーなどの光学素子の相対位置精度を高め、走査線曲がりの絶対量をできるだけゼロに近づけることにより画像品質の低下を回避している。ところで、近年、低コスト、取扱の容易性等の観点からプラスチック材料を使用した光学素子が用いられるようになった。しかし、プラスチック材料を使用した光学素子は、量産性に優れている一方で成形時の金型内温度の分布や金型から取り出した後の冷却が一律に行われないなどの理由から、製品形状が理想のものから外れてしまうことが多い。また、プラスチック材料を使用した光学素子はこれを支持する光学ハウジングに比べて熱膨張係数が高いため、光学素子に対する光学ハウジングの拘束力が大きいと、環境変化、すなわち温度変動により光学素子自身が変形しやすい。光ビームを感光体に結像させる光学素子群を構成する光学素子が少しでも変形していると、そのわずかな変形が光路の誤差を生じ、走査面上では無視できない大きさになる。特に変形が副走査方向に発生している場合には走査線曲がりが発生しやすくなる。このような問題に対処すべく、特開平10-268217号公報に開示された技術では、プラスチックレンズを強制的に変形させる湾曲調整手段を備え、湾曲調整手段によるプラスチックレンズの湾曲調整によって、成型時の歪みによる走査線曲がりを補正するようにしている。この技術は、プラスチックレンズの変形し易いという特性を逆に利用して、変形を意図的に制御するものである。

【0004】

【発明が解決しようとする課題】しかし、特開平10-268217号公報に開示された技術では、プラスチックレンズ自体を強制的に変形させてレンズ面を変形させ

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ることにより、レンズ成型時の歪みによる走査線曲がりを補正しているため、機構が複雑であるばかりでなく、レンズ面の変形により本来のレンズ機能が損なわれてしまう可能性もある。そこで本発明が解決しようとする課題は、レンズやミラーなどの光学素子の成型時の歪みによる走査線曲がりや面倒れを、レンズまたはミラーとして機能する部分を変形させることなく、従来よりも簡易に補正できる機構を備えた光走査装置を提供することにある。

【０００５】

【課題を解決するための手段】上記課題を解決するために、請求項１記載の発明は、レーザ光源から射出された光ビームを主走査方向に振らせる走査光学系と、当該走査光学系からの光ビームを副走査方向に移動する被照射面に結像させる光学素子群とを備えた光走査装置において、前記光学素子群を構成する光学素子のうちの少なくとも１つは、レンズまたはミラーとして機能する機能部と当該機能部を副走査方向に傾度調整可能に弾力的に支持する支持部とを一体成形したものであることを特徴とする。また、請求項２記載の発明は、複数のレーザ光源から射出された光ビームを主走査方向に振らせる走査光学系と、当該走査光学系からの複数の光ビームを、副走査方向に移動する被照射面に各々結像させる光学素子群とを備えた光走査装置において、前記光学素子群を構成する光学素子のうちの少なくとも１つは、レンズまたはミラーとして機能する機能部と当該機能部を副走査方向に傾度調整可能に弾力的に支持する支持部とを一体成形したものであることを特徴とする。なお、請求項１または２記載の発明において、前記光学素子は走査用レンズまたは面倒れ補正レンズであってもよい。また、請求項１または２記載の発明において、前記光学素子は走査用ミラーまたは面倒れ補正ミラーであってもよい。

【０００６】

【発明の実施の形態】以下、本発明の実施の形態について説明する。図１（ａ）は本発明に係る光走査装置の実施の形態の一例を示す平面図（筐体のカバーを外した状態）、図１（ｂ）は縦断面図である。この光走査装置１はレーザ光源２から出射された光ビーム３ａを、第１の光学素子群７を介してポリゴンスキャナ８のポリゴンミラー９に導光し、回転に伴って角度が変化するミラー面９ａで反射させることにより主走査方向（図１（ａ）中の矢印Ａ方向）に偏向させつつ、その偏向光３ｂを第２の光学素子群１３を介して副走査方向（図１（ｂ）中の矢印Ｂ方向）に回転する感光体ドラム１４の表面（被走査面）１４ａに導光することにより光走査を行う。上記レーザ光源２、第１の光学素子群７、ポリゴンスキャナ８および第２の光学群１３は一つの筐体２０内に収められている。近年画像出力の高速化あるいはカラー化に伴い、レーザ光源２として複数の発光源を組み合わせたものや、半導体レーザアレイなどが用いられてきている。

第１の光学素子群７は、カップリングレンズ４、絞り５および線像結像光学系６からなる。第２の光学素子群１３は、ｆθレンズ１０、走査レンズ１１および走査ミラー（折り返しミラー）１２からなる。筐体２０は、レーザ光源２、第１の光学素子群７、ポリゴンスキャナ８および第２の光学素子群１３が設置された筐体本体２０Ａと、筐体本体２０Ａの上部開口部を閉塞するカバー２０Ｂとからなる。筐体本体２０Ａの底部２０Ａａには、光ビーム出射窓２１が設けられている。光ビーム出射窓２１は、そこから埃やトナー等が筐体２０内に入り込むのを防止するために透明なガラス板２２で閉塞されている。レーザ光源２は発散性の光ビーム３ａを放射する。レーザ光源２からの光ビーム３ａは、カップリングレンズ４を透過することにより略平行光束に変換され、絞り５により所定の光束径に絞られた後、副走査方向に屈折力を有する線像結像光学系６によりポリゴンスキャナ８のミラー面９ａに主走査方向に延びる線状に結像される。ポリゴンスキャナ８は、ポリゴンミラー９と、これを等速で回転させるモータ１６とを備えており、ポリゴンミラー９の回転に伴うミラー面９ａの角度変化によって入射光束を等角速度的に偏向する。ポリゴンミラー９で反射した光ビーム（偏向光）３ｂは、ｆθレンズ１０および走査レンズ１１を経て走査ミラー１２に入射し、このミラー面で下方に折り返すようにして反射された後、光ビーム出射窓２１を通して筐体２０外に出射され、感光体ドラム１４の表面１４ａに照射される。このとき出力すべき画像に応じてレーザ光源２が強度変調されることにより、点滅する光ビーム３ｂによって感光体ドラム１４の表面１４ａにドットパターンの形で出力画像の静電潜像が書き込まれる。

【０００７】近年、安価に製造できかつ取り扱いが容易であるという理由から、レンズやミラーなど各種光学素子にプラスチック材料を使用したものが用いられるようになった。しかし、この種の光走査装置においては、ｆθレンズ１０や走査レンズ１１等のように主走査方向に長く延びた構造の光学素子が多く用いられるため、プラスチック材料を使用した場合、素子成形の過程で副走査方向に変形しやすいだけでなく、保持の仕方によっても副走査方向に変形することがある。光学素子の副走査方向への曲がりは感光体上における走査線曲がりの原因になるため、特開平１０－２６８２１７号公報に開示された技術のように、光学素子そのものを曲がりをなくす方向に力を加えた状態に保持して変形させることにより、曲がり量を減少させることが有効であると考えられる。ところが、この種の光学素子には強度を持たせるためにリブが設けられている場合が多いため、光学素子そのものの曲がり量を減少させるのは困難な場合が多い。そこで、本発明は、光学素子群を構成する光学素子の、レンズまたはミラーとして機能する機能部の形状は変化させることなく、光学素子（機能部）の曲がりや面倒れによ

る走査線曲がりを簡単に補正できる光走査装置を提供しようとするものである。

【０００８】この実施の形態では、走査レンズ１１とその保持部３０に本願発明を適用した場合を例にとり説明する。図１（ｃ）はその部分を主走査方向から見た断面図、図２は副走査方向から見た断面図である。図３は走査レンズ１１の実施の形態を例示する全体斜視図である。図示するように、走査レンズ１１は、レンズ部（機能部）１１ａと、レンズ部１１ａを補強するリブ１１ｂと、レンズ部１１ａおよびリブ１１ｂからなる部分を副走査方向に傾度調整可能に弾力的に支持する支持部１１ｃとをプラスチック材料により一体成形してなる。リブ１１ｂは、レンズ部１１ａの周囲を取り囲むようにして矩形枠状に形成されている。支持部１１ｃは、リブ１１ｂの下部に設けられた板ばね状の部分からなる。保持部３０は、筐体本体２０Ａの底部２０Ａａに一体形成された主走査方向に延びる箱形の構造に形成され、内部に走査レンズ１１を収容している。保持部３０の前後には、走査レンズ１１のレンズ部１１ａを露出させるべく窓部３１、３２が形成されている。保持部３０の底面３０ａは、リブ１１ｂの下部に対する支持部１１ｃの傾きを考慮して副走査方向に斜めに傾斜している。保持部３０の天井部の長手方向中央部にはレンズ角度調節ねじ３３が設けられている。レンズ角度調節ねじ３３は、保持部３０の天井部を貫通させて形成されたねじ孔に上方から螺合させて設けられており、その下部先端が走査レンズ１１のリブ１１ｂの上面に当接している。この実施の形態によれば、図１（ｃ）に示すように、レンズ角度調節ねじ３３を正逆方向（矢印Ｃ方向）に回動させて上下方向（矢印Ｄ方向）に移動させることにより、走査レンズ１１のレンズ部１１ａおよびリブ１１ｂからなる部分を副走査方向（矢印Ｂ方向）に回動させて、レンズ部１１ａの副走査方向の傾きを容易に調整することができる。その際、レンズ部１１ａはリブ１１ｂによって補強されており、支持部１１ｃのみの弾性変形によって傾き調整がなされるので、レンズ部１１ａが変形することはない。したがって、レンズ部１１ａの成型時の歪みによる走査線曲がりや面倒れを、レンズ部１１ａを変形させることなく、従来よりも簡易に補正することができる。上記の例は、プラスチックレンズとその保持部に関するものであるが、本願発明は走査ミラーや面倒れ補正ミラーなど反射面を有する光学素子とその保持部にも適用できる。

【０００９】図４（ａ）は走査ミラーの実施の形態を例示する全体斜視図、図４（ｂ）は走査ミラーとその保持部の構造を例示する断面図である。図示するように、走査ミラー４０は、ミラー部（機能部）４０ａと、ミラー部４０ａを補強するリブ４０ｂと、ミラー部４０ａおよびリブ４０ｂからなる部分を副走査方向に傾度調整可能に弾力的に支持する支持部４０ｃとをプラスチック材料により一体成形してなる。リブ４０ｂは、ミラー部４０ａの周囲を取り囲むようにして矩形枠状に形成されている。支持部４０ｃは、リブ４０ｂの下部に設けられた板ばね状の部分からなる。保持部４１は、筐体本体２０の底部などに一体形成された主走査方向に延びる箱形の構造に形成され、内部に走査ミラー４０を収容している。保持部４１の片側には、走査ミラー４０のミラー部４０ａを露出させるべく窓部４２が形成されている。保持部４１の底面４１ａは、リブ４０ｂの下部に対する支持部４２ｃの傾きを考慮して副走査方向に斜めに傾斜している。保持部４１の天井部の長手方向中央部にはミラー角度調節ねじ４３が設けられている。ミラー角度調節ねじ４３は、保持部４１の天井部を貫通させて形成されたねじ孔に上方から螺合させて設けられており、その下部先端が走査ミラー４０のリブ４０ｂの上面に当接している。この実施の形態によれば、図１（ｃ）に示すように、ミラー角度調節ねじ４３を正逆方向（矢印Ｃ方向）に回動させて上下方向（矢印Ｄ方向）に移動させることにより、走査ミラー４０のミラー部４０ａおよびリブ４０ｂからなる部分を副走査方向（矢印Ｂ方向）に回動させて、ミラー部４０ａの副走査方向の傾きを容易に調整することができる。その際、ミラー部４０ａはリブ４０ｂによって補強されており、支持部４０ｃのみの弾性変形によって傾き調整がなされるので、ミラー部４０ａが変形することはない。したがって、ミラー部４０ａの成型時の歪みによる走査線曲がりや面倒れを、ミラー部４０ａを変形させることなく、従来よりも簡易に補正することができる。

【００１０】なお、上記の実施の形態では、レーザ光源から射出された光ビームを走査して１つの被走査体に書き込みを行うタイプの光走査装置を例にとり説明したが、本願発明は、複数のレーザ光源から射出された光ビームを同時に走査して、１つの被走査体の複数箇所に同時に書き込みを行うタイプや、複数の被走査体に同時に書き込みを行うタイプの光走査装置にも有効に適用できることは無論である。たとえば、図５に示したような、タンデム方式の多色画像形成装置の光走査装置において、光学素子群を構成する光学素子、たとえばＦθレンズ５２ｃ、５２■、５２ｙ、５２ｋ、走査ミラー５３ｃ、５３■、５３ｙ、５３ｋとそれらの保持部の本願発明の構造（たとえば図１、図４に示したような構造）を適用することにより、それらのレンズ部やミラー部の成型時の歪みによる走査線曲がりや面倒れを、レンズ部やミラー部を変形させることなく簡易に補正することができるので、各光ビームの走査線を正確に重ね合わせて、画像品質を向上させることができる。走査線曲がりが生じていても、ＣＭＹＫのすべての走査線の方向と量が同程度であれば、色ズレは目立たなくできる。

【００１１】

【発明の効果】以上説明したように、本願発明の光走査装置によれば、レンズやミラーなどの光学素子の成型時

の歪みによる走査線曲がりや面倒れを、レンズまたはミラーとして機能する部分を変形させることなく、所望の値に収めることができるので、光学素子単品の形状公差と光走査装置への組付け公差に対する許容度を有効に緩和させることができる。本願発明を多色画像形成装置の光走査装置に適用すれば、複数の走査線が重なるように、走査線曲がりや面倒れを容易に所望の値に収めることができるので、色ズレの少ない良好な画像が容易に得られるようになる。

【図面の簡単な説明】

【図1】（a）は本発明に係る光走査装置の実施の形態の一例を示す平面図、（b）は同光走査装置の縦断面図、（c）は同光走査装置の走査レンズとその保持部の部分を主走査方向から見た断面図である。

【図2】図1に示す光走査装置の走査レンズとその保持部の部分を副走査方向から見た断面図である。

【図3】図1、図2に示す走査レンズの斜視図である。

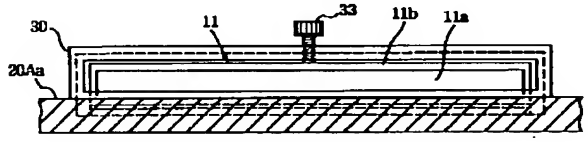
【図4】（a）は本願発明の実施の形態の一例を示す走査ミラーの斜視図、（b）は同走査ミラーとその保持部の部分を主走査方向から見た断面図である。

【図5】タンデム方式の多色画像形成装置の要部概略図である。

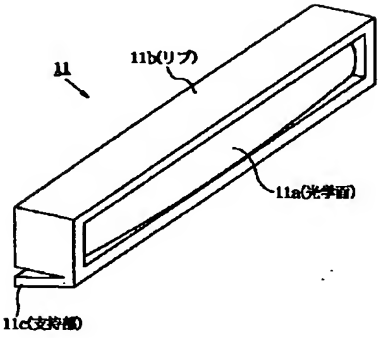
【符号の説明】

1：光走査装置
2：レーザ光源
3a：光ビーム
3b：偏向光
4：カップリングレンズ
5：絞り
6：線像結像光学系
7：第1の光学素子群
9：ポリゴンミラー
10：fθレンズ
11：走査レンズ
11a：レンズ部（機能部）
11b：リブ
11c：支持部
12：走査ミラー
13：第2の光学素子群
14：感光体ドラム
14a：被走査面
31、32：窓部
33：レンズ角度調節ねじ
40：走査ミラー
40a：ミラー部（機能部）
40b：リブ
40c：支持部
41：保持部
42：窓部
43：ミラー角度調節ねじ

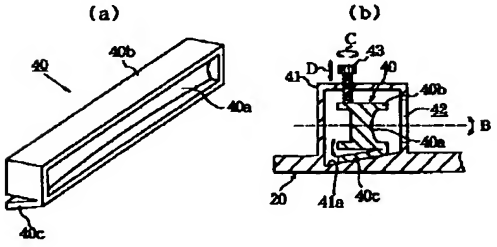
【図2】



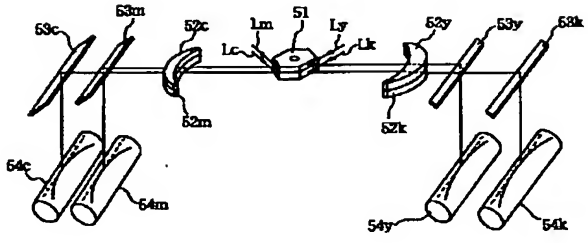
【図3】



【図4】

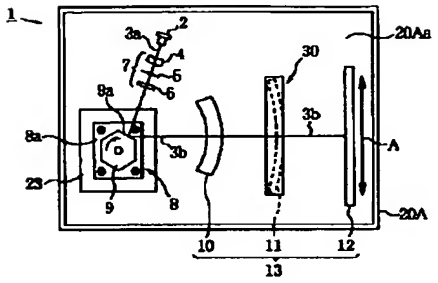


【図5】

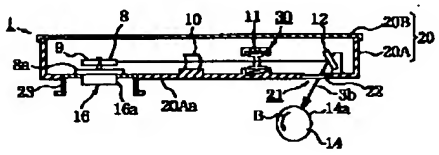


【図1】

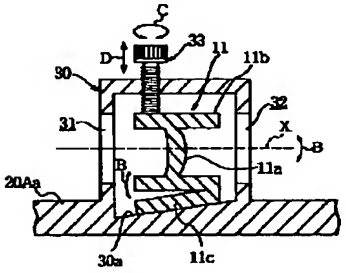
(a)


1
2
3a
4
5
6
7
8a
8
9
10
11
12
13
20Aa
20A
30
3b
A

(b)


1
8
10
11
30
12
20B
20
20A
8a
23
16
16a
20Aa
21
3b
22
14a
14

(c)


C
D
33
11
11b
30
31
32
X
B
11a
20Aa
30a
11c